

April 15, 2005

Mr. Jeffrey S. Forbes
Site Vice President
Arkansas Nuclear One
Entergy Operations, Inc.
1448 S. R. 333
Russellville, AR 72801

SUBJECT: ARKANSAS NUCLEAR ONE, UNITS 1 AND 2 - SAFETY EVALUATION AND
EXEMPTION FROM THE REQUIREMENTS 10 CFR PART 50, APPENDIX A
(TAC NOS. MC1227 AND MC1228)

Dear Mr. Forbes:

The Commission has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criterion (GDC) 57, for Arkansas Nuclear One, Unit 2 (ANO-2). This action is in response to your letter of October 30, 2003, as supplemented by letters dated July 1, November 15, and December 3, 2004, and March 3, 2005, that submitted an application for an exemption from GDC 57 for Arkansas Nuclear One, Units 1 and 2, which would allow for plant operation at power with the applicable manual upstream containment isolation valves associated with the emergency feedwater system steam traps and the atmospheric dump valve drain steam traps (i.e., one applicable valve per steam trap) in the open position. However, the NRC staff determined that an exemption is not needed for Arkansas Nuclear One, Unit 1 (ANO-1) and thus, an exemption is granted for ANO-2 only. Therefore, enclosed is a Safety Evaluation for ANO-1 (Enclosure 1) and an exemption for ANO-2 (Enclosure 2).

A copy of the exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

/RA/

Thomas Alexion, Project Manager, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket Nos. 50-313 and 50-368

Enclosure 1: Safety Evaluation for ANO-1

Enclosure 2: Exemption for ANO-2

cc w/enclosures: See next page

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The Commission has approved the enclosed exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criterion (GDC) 57, for Arkansas Nuclear One, Unit 2 (ANO-2). This action is in response to your letter of October 30, 2003, as supplemented by letters dated July 1, November 15, and December 3, 2004, and March 3, 2005, that submitted an application for an exemption from GDC 57 for Arkansas Nuclear One, Units 1 and 2, which would allow for plant operation at power with the applicable manual upstream containment isolation valves associated with the emergency feedwater system steam traps and the atmospheric dump valve drain steam traps (i.e., one applicable valve per steam trap) in the open position. However, the NRC staff determined that an exemption is not needed for Arkansas Nuclear One, Unit 1 (ANO-1) and thus, an exemption is granted for ANO-2 only. Therefore, enclosed is a Safety Evaluation for ANO-1 (Enclosure 1) and an exemption for ANO-2 (Enclosure 2).

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Thomas Alexion, Project Manager, Section 1
Project Directorate IV
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO PLANT OPERATION WITH CERTAIN

CONTAINMENT ISOLATION VALVES OPEN

RENEWED FACILITY OPERATING LICENSE NO. DPR-51

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT 1

DOCKET NO. 50-313

1.0 INTRODUCTION

By application dated October 30, 2003, and supplemented by letters dated July 1, November 15, and December 3, 2004, and March 3, 2005, Entergy Operations, Inc. (the licensee), requested a permanent exemption from Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, Appendix A, General Design Criterion (GDC) 57 for certain containment isolation valves (CIVs) at Arkansas Nuclear One, Unit 1 (ANO-1). Specifically, the licensee requests an exemption for the applicable manual upstream CIVs associated with the two emergency feedwater (EFW) system steam traps and the applicable manual upstream CIV associated with the atmospheric dump valve (ADV) drain steam trap. This will allow the plant to operate at power with these CIVs open, rather than locked closed.

2.0 REGULATORY EVALUATION

As stated in 10 CFR Part 50, Appendix A, GDC 57, regarding closed system CIVs:

Each line that penetrates primary reactor containment and is neither part of the reactor coolant pressure boundary nor connected directly to the containment atmosphere shall have at least one containment isolation valve which shall be either automatic, or locked closed, or capable of remote manual operation. This valve shall be outside containment and located as close to the containment as practical. A simple check valve may not be used as the automatic isolation valve.

The CIVs under review are located on main steam lines outside containment, but upstream of the main steam isolation valves (MSIVs). The main steam and feedwater lines inside containment, in combination with the secondary side of the steam generators, constitute closed systems inside containment, so GDC 57 applies. The CIVs are not automatic or capable of remote manual operation, and the licensee does not wish to keep them locked closed.

The Commission, through its Secretary, has stated, in the Staff Requirements Memorandum for SECY-92-223 (ADAMS Accession No. ML003763736, dated September 18, 1992):

At the time of promulgation of Appendix A to 10 CFR Part 50, the Commission stressed that the GDC were not new requirements and were promulgated to more clearly articulate the licensing requirements and practice in effect at that time. While compliance with the intent of the GDC is important, each plant licensed before the GDC were formally adopted was evaluated on a plant specific basis, determined to be safe, and licensed by the Commission. Furthermore, current regulatory processes are sufficient to ensure that plants continue to be safe and comply with the intent of the GDC.... **Plants with construction permits issued prior to May 21, 1971 do not need exemptions from the GDC** [emphasis added].

In accordance with this statement, ANO-1 does not require the requested exemption because its construction permit was issued on December 6, 1968. Although ANO-1 does not require an exemption, the Commission's statement enjoins the staff to ensure that plants continue to be safe and comply with the intent of the GDC. The technical review for ANO-1 follows, although ANO-1 will not receive an exemption.

3.0 TECHNICAL EVALUATION

3.1 Operation with the EFW Steam Trap CIVs and the ADV Drain Steam Trap CIV Open

The steam supply lines for the ANO-1 EFW pump and the ADVs tap off of the "A" and "B" main steam headers outside containment and upstream of the MSIVs. Both EFW steam supplies have a steam trap upstream of the EFW pump turbine isolation valve, which is a GDC 57 boundary valve. Therefore, the upstream CIVs for these steam traps are subject to GDC 57. The manual isolation valves for these steam traps (which include the upstream CIVs) are normally open during power operation. Keeping the EFW steam trap isolation valves closed during operation potentially threatens the operability of the steam-driven EFW pump, due to condensate buildup. The ADV associated with the "A" main steam header has a drain steam trap whose isolation valves are also maintained open during power operation. The upstream CIV for this steam trap is also subject to GDC 57. Keeping the ADV drain steam trap isolation valves closed during operation could cause the potential for waterhammer when an ADV line is opened and damage the piping associated with the ADV, due to condensate buildup. Since these applicable CIVs (associated with the EFW and ADV drain steam traps) are manual CIVs and do not have remote closure capability, GDC 57 requires that they be locked closed. Therefore, the licensee requests an exemption from the requirements of GDC 57 to keep these CIVs open during operation. However, since the construction permit for ANO-1 was issued before May 21, 1971, an exemption from GDC 57 is not required and the NRC staff will treat GDC 57 as a recommendation in the remainder of this Safety Evaluation for ANO-1.

Operating with the ANO-1 EFW steam traps and ADV drain steam trap CIVs open results in having only the secondary system pressure boundary inside containment as a barrier against the release of radioactivity to the environment through the steam trap piping. However, the licensee has evaluated the effects of these valves being open during power operation (provided below) and has shown this to have no impact on the consequences of any of the events evaluated in the Safety Analysis Report (SAR). Operating with the EFW steam trap CIVs

closed and the ADV drain steam trap CIV closed could compromise the operability of the EFW pump turbine and damage the piping associated with the ADV, due to condensate buildup.

Of the 17 events listed in Chapter 14 of the ANO-1 SAR, only eight involve a radiation dose consequence evaluation. Two of these, the waste gas decay tank rupture and the fuel handling accident, need not be evaluated since they cannot physically involve a release through the EFW and ADV steam trap CIVs. The remaining six events are the main steam line break, rod ejection accident, loss of electric power, loss-of-coolant accident (LOCA), maximum hypothetical accident, and steam generator tube failure.

The limiting main steam line break analysis assumes that the break occurs between the reactor building and a MSIV. Therefore, the EFW and ADV steam trap CIVs being open during this event does not impact the dose consequence evaluation.

A secondary system isolation is not assumed following a rod ejection accident or loss of electric power event. Therefore, having the CIVs for the EFW and ADV steam traps open would not impact the dose consequences of these events.

For the LOCA, activity in the secondary system is not considered in the dose estimate in the SAR because of the massive radioisotope inventories that are conservatively and deterministically considered to be in the containment building. No credit is taken for the isolation of any secondary system flowpath. Also, pertinent regulations (e.g., 10 CFR Part 50, Appendix J, Option A, section II.H.4) assume that the closed system inside containment remains intact during the accident. Therefore, having the EFW and ADV steam trap CIVs open during this event does not impact the evaluation.

The licensee states that the maximum hypothetical accident analysis assumes fission product releases greater than any that could actually occur to demonstrate that the plant design is adequate to preclude any undue risk to the general public. Secondary system isolation is not assumed for this event. Therefore, leaving the EFW and ADV steam trap CIVs open would have no effect on the consequences of this event.

The steam generator tube rupture analysis does not generate a main steam line isolation signal and automatic isolation of the affected steam generator is not assumed. The analysis assumes that the affected generator is isolated at 34 minutes by reducing reactor coolant system temperature to a value lower than a temperature corresponding to a saturation pressure below the setpoint of the main steam safety valves. This effectively stops the tube leak. All of the reactor coolant mass that leaked to the secondary system prior to termination of the primary to secondary leak is assumed to exit to atmosphere either through the main steam safety valves or through the condenser. The discharge of the subject traps is routed to the condenser. Therefore, leaving the EFW and ADV steam trap CIVs open would have no effect on the consequences of this event.

The staff has evaluated the licensee's analyses and makes the following findings:

- a) Only 6 of the 17 Chapter 14 events need to be evaluated, for the reasons given above.

- b) For the main steam line break and steam generator tube rupture, the releases are assumed to occur through pathways other than the subject steam trap CIVs, so the position of these valves has no effect on the consequences of the accidents.
- c) The rod ejection accident and loss of electric power accident analyses do not assume secondary system isolation (which includes the subject steam trap CIVs), so the position of these CIVs has no effect on the analyzed dose consequences.
- d) For the LOCA and maximum hypothetical accident, secondary system isolation is not assumed in the analyses, and pre-existing secondary system radioactivity is insignificant compared to the analyzed releases, so the position of the subject steam trap CIVs has no effect on the analyzed dose consequences.

Based on the above discussion, leaving the EFW and ADV steam trap CIVs open during power operation would have no impact on the consequences of any of the accidents evaluated in the SAR.

3.2 Alternate Solutions

The licensee has stated that operating with the EFW steam trap CIVs closed and the ADV drain steam trap CIV closed could compromise the operability of the EFW pump turbine and damage the piping associated with the ADV, due to condensate buildup. However, in its October 30, 2003, letter, the licensee did not explicitly address another possible alternative to the requested exemption; that being, to bring the CIVs (associated with the EFW and ADV drain steam traps) into compliance with GDC 57 by installing remote manual operators on the CIVs. The CIVs could then be left open during plant operation. In its supplemental letter dated July 1, 2004, the licensee stated again that leaving the CIVs open during power operation would have no impact on the consequences of any of the accidents evaluated in the SAR. Considering this, the licensee believes that any potential benefit derived from implementing a modification to install remote manual operators on the subject CIVs would not be commensurate with the cost and resource burden associated with preparing and implementing the modification. Therefore, the licensee believes that the most expeditious, efficient, and cost effective resolution of the nonconformance with GDC 57 is the subject exemption request.

Although the staff considers there to be significant safety value to the dual, redundant barrier concept of containment isolation, the staff finds that, in this case, given the SAR analyses and the assumption of an intact closed system inside containment during a LOCA, it is not necessary to require compliance with the explicit requirements of the regulation in order to achieve the underlying purpose of the regulation, which is to ensure that the primary containment serves as an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment, because leaving the EFW and ADV steam trap CIVs open during power operation would have no impact on the consequences of any of the accidents evaluated in the SAR. Thus, the staff finds that the safety benefits of the modification are not commensurate with the cost.

4.0 CONCLUSION

The staff finds that, based on the above, it is not necessary, in this case, for the subject CIVs to be locked closed, automatic, or remote manual, as stated in GDC 57, in order to achieve the underlying purpose of GDC 57. Therefore, the staff concludes that operation of ANO-1 with the subject CIVs open is acceptable, and that the requested exemption from GDC 57 is unnecessary.

Principal Contributor: J. Pulsipher

Date: April 15, 2005

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ENTERGY OPERATIONS, INC.
ARKANSAS NUCLEAR ONE, UNIT 2
DOCKET NO. 50-368
EXEMPTION

1.0 BACKGROUND

Entergy Operations, Inc. (the licensee) is the holder of Facility Operating License No. NPF-6 which authorizes operation of the Arkansas Nuclear One, Unit 2 (ANO-2) nuclear power plant. The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (NRC, the Commission) now or hereafter in effect.

The facility consists of a pressurized water reactor located in Pope County, Arkansas.

2.0 REQUEST/ACTION

Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Appendix A, General Design Criterion (GDC) 57, regarding closed system containment isolation valves (CIVs), states:

Each line that penetrates primary reactor containment and is neither part of the reactor coolant pressure boundary nor connected directly to the containment atmosphere shall have at least one containment isolation valve which shall be either automatic, or locked closed, or capable of remote manual operation. This valve shall be outside containment and located as close to the containment as practical. A simple check valve may not be used as the automatic isolation valve.

By application dated October 30, 2003, and supplemented by a letters dated July 1, November 15, and December 3, 2004, and March 3, 2005, the licensee requested a permanent exemption from 10 CFR Part 50, Appendix A, GDC 57 for certain CIVs at ANO-2. Specifically, the licensee requests an exemption for the applicable manual upstream CIV associated with the emergency feedwater (EFW) system steam trap and the applicable manual upstream CIV associated with the atmospheric dump valve (ADV) drain steam trap. This will allow the plant to operate at power with these CIVs open, rather than locked closed.

The CIVs under review are located on main steam lines outside containment, but upstream of the main steam isolation valves (MSIVs). The main steam and feedwater lines inside containment, in combination with the secondary side of the steam generators, constitute closed systems inside containment, so GDC 57 applies. The CIVs are not automatic or capable of remote manual operation, and the licensee does not wish to keep them locked closed.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when (1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and (2) when special circumstances are present.

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present in that plant operation with the applicable manual upstream CIV associated with the EFW system steam trap and the applicable manual upstream CIV associated with the ADV drain steam trap in the closed position is not necessary to achieve the underlying purpose of 10 CFR Part 50, Appendix A, GDC 57. The staff's rationale is as follows.

Operation with the EFW Steam Trap CIVs and the ADV Drain Steam Trap CIVs Open

The steam supply lines for the ANO-2 EFW pump and the ADVs tap off of the “A” and “B” main steam headers outside containment and upstream of the MSIVs. The steam supply from the “B” main steam header has a steam trap upstream of the EFW pump turbine isolation valve, which is a GDC 57 boundary valve. Therefore, the upstream CIV for this steam trap is subject to GDC 57. The manual isolation valves for this steam trap (which include the upstream CIV) are normally open during power operation. Keeping the EFW steam trap isolation valves closed during operation potentially threatens the operability of the steam-driven EFW pump. It is noted that the EFW steam trap for the “A” EFW pump turbine is located downstream of the turbine isolation valve. The ADV associated with the “A” main steam header has a drain steam trap whose isolation valves are also maintained open during power operation. The upstream CIV for this steam trap is also subject to GDC 57. Keeping the ADV drain steam trap isolation valves closed during operation could cause the potential for waterhammer when an ADV line is opened and damage the piping associated with the ADV, due to condensate buildup. Since these applicable CIVs (associated with the EFW and ADV drain steam traps) are manual CIVs and do not have remote closure capability, GDC 57 requires that they be locked closed. Therefore, the licensee requests an exemption from the requirements of GDC 57 to keep these CIVs open during operation.

Operating with the ANO-2 EFW steam trap and ADV drain steam trap CIVs open results in the secondary system pressure boundary inside containment providing the only barrier against the release of radioactivity to the environment through the steam trap piping. However, the licensee has evaluated the effects of these valves being open during power operation (provided below) and has shown this to have no impact on the consequences of any of the events evaluated in the Safety Analysis Report (SAR). Operating with the EFW steam trap CIVs closed and the ADV drain steam trap CIV closed could compromise the operability of the

EFW pump turbine and damage the piping associated with the ADV, due to condensate buildup.

Of the 36 events listed in Chapter 15 of the ANO-2 SAR, only ten involve a radiation dose evaluation. The waste gas decay tank rupture and the fuel handling accident need not be evaluated since they cannot physically involve the EFW and ADV steam trap CIVs. Additionally, the malfunction of the turbine gland sealing system can also be eliminated from evaluation since it is bounded by the turbine trip event, which will be discussed below. The remaining seven events are turbine trip, loss of alternating current (AC) power, excess heat removal, main steam/feed line break, loss of reactor coolant system (RCS) forced flow, loss-of-coolant accident (LOCA), and steam generator tube rupture.

For the turbine trip, loss of AC power, excess heat removal, and main steam/feed line break, no post-event RCS activity is involved in the dose estimate since the RCS integrity is not compromised. Having the EFW and ADV steam trap CIVs open would not impact this event since the containment isolation function is not a factor.

For the loss of RCS forced flow, only the reactor coolant pump shaft seizure has a dose estimate, and that dose estimate is based on a normal cool down to shutdown cooling with no secondary isolations assumed. Therefore, having the EFW and ADV steam trap CIVs open would not impact this event.

For the LOCA, activity in the secondary system is not considered in the dose estimate because of the massive radioisotope inventories that are conservatively and deterministically considered to be in the containment building. No credit for the closure of the MSIVs or other secondary system flowpaths is taken for this analysis unless a passive failure of the secondary system pressure boundary inside containment is assumed. Since the design and quality of the secondary system process and drain lines inside containment is equivalent to that of the containment liner, a passive failure of this piping is not considered in the SAR analysis. Also,

pertinent regulations (e.g., 10 CFR Part 50, Appendix J, Option A, section II.H.4) assume that the closed system inside containment remains intact during the accident. Therefore, having the EFW and ADV steam trap CIVs open would not impact this event.

For the steam generator tube rupture, no containment isolation signal or main steam isolation signal would be generated. Manual isolation of the affected steam generator is assumed to occur 60 minutes following a steam generator tube rupture, followed by cool down to shutdown cooling conditions using the unaffected steam generator. The isolation of the affected steam generator includes the local manual isolation of the EFW and ADV steam traps. Therefore, the fact that they are not equipped to be operated remotely has no effect on analyzed dose consequences.

The staff has evaluated the licensee's analyses and makes the following findings:

- a) Only 7 of the 36 Chapter 15 events need to be evaluated, for the reasons given above.
- b) For the turbine trip, loss of AC power, excess heat removal, and main steam/feed line break, the containment isolation function is not a factor, so the position of the subject steam trap CIVs has no effect on the consequences of the accidents.
- c) The loss of RCS forced flow event analysis does not assume secondary system isolation (which includes the subject steam trap CIVs), so the position of these CIVs has no effect on the analyzed dose consequences.
- d) For the LOCA, secondary system isolation is not assumed in the analyses, and pre-existing secondary system radioactivity is insignificant compared to the analyzed releases, so the position of the subject steam trap CIVs has no effect on the analyzed dose consequences.
- e) For the steam generator tube rupture event, no containment isolation signal or main steam isolation signal would be generated. The analysis assumes the local manual isolation of the subject steam trap CIVs. Therefore, the licensee's proposal, to allow the

subject steam trap CIVs to remain open during power operation, with only local manual closure capability, is consistent with the event analysis.

Based on the above discussion, leaving the EFW and ADV steam trap CIVs open during power operation would have no impact on the consequences of any of the accidents evaluated in the SAR.

Alternate Solutions

The licensee has stated that operating with the EFW steam trap CIV closed and the ADV drain steam trap CIV closed could compromise the operability of the EFW pump turbine and damage the piping associated with the ADV, due to condensate buildup. However, in its October 30, 2003, letter, the licensee did not explicitly address another possible alternative to the requested exemption; that being, to bring the CIVs (associated with EFW and ADV drain steam traps) into compliance with GDC 57 by installing remote manual operators on the CIVs. The CIVs could then be left open during plant operation. In its supplemental letter dated July 1, 2004, the licensee stated again that leaving the CIVs open during power operation would have no impact on the consequences of any of the accidents evaluated in the SAR. Considering this, the licensee believes that any potential benefit derived from implementing a modification to install remote manual operators on the subject CIVs would not be commensurate with the cost and resource burden associated with preparing and implementing the modification. Therefore, the licensee believes that the most expeditious, efficient, and cost effective resolution of the nonconformance with GDC 57 is the subject exemption request.

Although the staff considers there to be significant safety value to the dual, redundant barrier concept of containment isolation, the staff finds that, in this case, given the SAR analyses and the assumption of an intact closed system inside containment during a LOCA, it is not necessary to require compliance with the explicit requirements of the regulation in order to achieve the underlying purpose of the regulation, which is to ensure that the primary

containment serves as an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment, because leaving the EFW and ADV steam trap CIVs open during power operation would have no impact on the consequences of any of the accidents evaluated in the SAR. Thus, the staff finds that the safety benefits of the modification are not commensurate with the cost.

Summary

The staff finds that, based on the above, it is not necessary, in this case, for the subject CIVs to be locked closed, automatic, or remote manual, as required by GDC 57, in order to achieve the underlying purpose of GDC 57. Therefore, pursuant to 10 CFR 50.12(a)(2), the staff concludes that the operation of ANO-2 with the subject CIVs open is acceptable, and that the requested exemption from GDC 57 is justified.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants Entergy Operations, Inc. an exemption from the requirements of 10 CFR Part 50, Appendix A, GDC 57, to allow ANO-2 to operate with the applicable manual upstream CIV associated with the EFW system steam trap and the applicable manual upstream CIV associated with the ADV drain steam trap in the open position.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment (70 FR 19106).

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 15th day of April 2005.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Ledyard B. Marsh, Director
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